

REMARKS

The present amendment is in response to the final office action dated May 10, 2006 where the Examiner finally rejected claims 1-21. Although, the Applicant disagrees with the Examiner's grounds for rejection, the Applicant has amended the independent claims to expedite the prosecution of this patent application. More particularly, the Applicant responds to the detailed action and respectfully requests that the finality of the application be withdrawn and that claims 1-21 detailed in the application be placed in a state of allowance.

Prior Art Rejections (35 U.S.C. §103)

The office action has again rejected claims 1-21 under 35 U.S.C. §103 as being anticipated by U.S. Patent 6,465,888 to Chooi, et al. (hereinafter "Chooi") in view of U.S. Patent Application 2002/0081854 to Morrow, et al. (hereinafter "Morrow").

It appears that the present action maintains that Chooi teaches all the limitations found in the claims, except that the Chooi reference does not teach removing the photoresist film from the surface of the structure by using carbon monoxide gas. However, Morrow is relied upon as teaching, "the only feature that is known in the semiconductor art to remove the photoresist film by using CO (see figures 5e, paragraph #54)" (see Office Action, page 5). The office action concludes that "Chooi in view of Morrow do teach oxidizing gas mixture comprising carbon monoxide (CO) to remove the photoresist when the dielectric has been previously etched to expose the barrier layer" (see Office Action, page 5).

Applicant's currently amended claims are distinguishable from the prior art because they comprise, firstly, etching the dielectric layer using a first fluorine containing gas that generates a fluorinated polymer and exposing the barrier layer, secondly, feeding an oxidizing gas mixture into a reactor wherein the oxidizing gas mixture comprises carbon monoxide (CO), energizing the oxidizing gas mixture having carbon monoxide (CO) to generate a plasma in said reactor; and-selectively removing the photoresist layer with said oxidizing gas mixture comprising carbon monoxide (CO), wherein the oxidizing gas mixture reacts with the fluorinated polymer deposited on the IC, thereby minimizing the loss of the exposed barrier material during the removing of the photoresist layer.

Support for these claim amendments is provided in the Applicant's specification, in which the Applicant states *inter alia*, "after etching using a fluorine containing gas, a fluorinated polymer is generated which is deposited on the IC structure and in the reactor... the fluorinated polymer then reacts with well-known gas mixtures that are used to strip the photoresist" (see Specification, par. [0035]). Thus, "it is hypothesized that the carbon monoxide scavenges fluorine from polymerized fluorine (C_xH_yF_z) deposited on the IC and/or the reactor," (see Specification, lines 8-10 par. [0035]) and, "the carbon monoxide reacts with or 'scavenges' the fluorine from the fluorine containing gas, so that the fluorine containing gas etch little or none of the exposed barrier layer 308" (see Specification, lines 9-12, par. [0046]). Additionally, "the use of carbon monoxide in the stripping process enables thinner barrier layers to be applied to the IC structure, and thereby results in reduce capacitance of the copper interconnect... enables the stripping process to be performed in the same reactor that is used for etching" (see Specification, lines 12-18 par. [0035]).

Firstly, Applicant respectfully submits that no mention is made in either Chooi or Morrow about generating a fluorinated polymer after using a fluorine containing gas to etch a dielectric material and then using an oxidizing gas that comprises carbon monoxide (CO) to react with the fluorinated polymer that is deposited on the IC. The Examiner shall appreciate that each element of the claimed subject matter must be taught in the prior art, and the elements described in the amended claims are simply not taught by Chooi and/or Morrow.

Additionally, Chooi, et al. and Morrow, et al. do not teach or suggest removing the photoresist layer by using mixture of carbon monoxide gas (CO). As argued previously in Applicant's prior detailed response, in Morrow, for instance, "the plasma formed from the mixture of carbon monoxide gas (CO), oxygen and nitrogen gas is mainly used in an etching/patterning process rather than a removing/stripping photoresist process" (see remarks section, "RESPONSE TO OFFICE ACTION" filed February 13, 2007).

Furthermore, the carbon monoxide (CO) as recited in Applicant's newly amended claim is not merely for removing the photoresist layer but the carbon monoxide (CO) also reacting with the fluorinated polymer that is deposited on the IC, thereby minimizing the etching of the exposed barrier by the fluorine gas and minimizing the loss of the exposed barrier material during the removing of the photoresist layer.

In Morrow, "if a plasma formed from a mixture of carbon monoxide gas (CO), oxygen and nitrogen gas is used to perform the etching step, the photoresist layer 530 may be removed at the same time via 540 is etched through layer 556" (see Morrow, figure 5e, paragraph par. 54). Even if the carbon monoxide (CO) was used for removing the photoresist layer in Morrow, which Applicant denies, Morrow still fails to teach how

it affects, and how the carbon monoxide (CO) protects, the exposed barrier layer from being etched.

The Office Action notes that Chooi would not remove the barrier layer since the removal of the photoresist layer can use any single or combination of gases such as chlorine, hydrogen bromide, oxygen, nitrogen, argon and carbon monoxide (see office action, page 6). However, Chooi only mentions that “the first photoresist layer and BARC are removed, preferably by oxygen plasma ashing.” Thus, Chooi fails show using carbon monoxide (CO) for photoresist removal as claimed by the Applicant.

Therefore, Chooi does not teach nor suggest all the newly amended features of claims 1-21, and Chooi does not describe or suggest the elements of the claims, either separately or in combination with Morrow.


Applicant has also amended all the remaining independent claims 9, 15, 20, and 21 in a manner that is similar to claim 1. The Applicant respectfully submits that all of the independent claims overcome the Examiner’s cited references in the obviousness rejection.

Conclusion

For all the foregoing reasons, allowance of pending claims 1-21 in the present application is respectfully requested.

Respectfully Submitted,

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Michael A. Kerr
Patent Attorney
Reg. No. 42,722

Michael A. Kerr
VIRTUAL LEGAL, P.C.
3476 Executive Pointe Way, Ste. 16
Carson City, NV 89706
Tel: (775) 841-3388
Fax: (775) 841-3389